# Complete Summary

## GUIDELINE TITLE

ACR Appropriateness Criteria™ for suspected bacterial endocarditis.

## BIBLIOGRAPHIC SOURCE(S)

Higgins CB, Levin DC, Bettmann MA, Gomes AS, Grollman J, Henkin RE, Hessel SJ, Kelley MJ, Needleman L, Polak JF, Stanford W, Wexler L, Abbott W, Port S. Suspected bacterial endocarditis. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):73-7. [24 references]

## COMPLETE SUMMARY CONTENT



## SCOPE

### DISEASE/CONDITION(S)

Bacterial endocarditis

### GUIDELINE CATEGORY

Diagnosis

### CLINICAL SPECIALTY

Cardiology
Family Practice
Internal Medicine
Radiology

### INTENDED USERS

Health Plans
Hospitals

Managed Care Organizations
Physicians
Utilization Management

### GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for suspected bacterial endocarditis

### TARGET POPULATION

Patients with suspected bacterial endocarditis

### INTERVENTIONS AND PRACTICES CONSIDERED

1. Chest x-ray
2. Transthoracic echocardiography with Doppler
3. Transthoracic echocardiography without Doppler
4. Transesophageal echocardiography
5. Magnetic resonance imaging
6. Cardiac catheterization and angiography
7. Electron beam computed tomography
8. Computed tomography
9. Indium-label white blood cell study
10. Cardiac series

### MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles

### NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

### METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Delphi Method)
Weighting According to a Rating Scheme (Scheme Not Given)

## RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

## METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

## DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

## METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

## DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible.

## RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

## COST ANALYSIS

In a recent study, transthoracic echocardiography (TTE) was found to be the more cost effective test in patients with intermediate or high pretest probability of infective endocarditis (IE). This study concluded that transesophageal

echocardiography (TEE) should be reserved for patients with suspected infective endocarditis on prosthetic valves or those in whom transthoracic echocardiography yields intermediate probability results.

### METHOD OF GUIDELINE VALIDATION

Internal Peer Review

### DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Suspected Bacterial Endocarditis

Variant 1: With signs of congestive heart failure.

| Radiologic Exam Procedure | Appropriateness Rating | Comments |
|---|---|---|
| Chest X-ray | 9 | |
| Transthoracic Echocardiography with Doppler | 8 | |
| Transthoracic Echocardiography without Doppler | 6 | |
| Transesophageal Echocardiography | 6 | Only for prosthetic valves or transthoracic echocardiography nondiagnostic or transthoracic echocardiography inadequate. |
| Magnetic Resonance Imaging | 6 | Probably indicated to rule out paravalvular abscess. |
| Cardiac Catheterization and angiography | 6 | Indicated preoperatively. |
| Electron Beam Computed Tomography | 4 | |
| Computed Tomography | 4 | |

| | | |
|---|---|---|
| Indium-labeled White Blood Cell Study | 4 | |
| Cardiac Series | 2 | |
| Appropriateness Criteria Scale<br><br>1 2 3 4 5 6 7 8 9<br><br>1=Least appropriate 9=Most appropriate | | |

Variant 2: Without signs of congestive heart failure.

| Radiologic Exam Procedure | Appropriateness Rating | Comments |
|---|---|---|
| Chest X-ray | 9 | |
| Transthoracic Echocardiography with Doppler | 8 | |
| Transthoracic Echocardiography without Doppler | 6 | |
| Transesophageal Echocardiography | 6 | |
| Magnetic Resonance Imaging | 6 | |
| Electron Beam Computed Tomography | 4 | |
| Computed Tomography | 4 | |
| Indium-labeled White Blood Cell Study | 4 | |
| Cardiac Catheterization and Angiography | 4 | |
| Cardiac Series | 2 | |
| Appropriateness Criteria Scale<br><br>1 2 3 4 5 6 7 8 9<br><br>1=Least appropriate 9=Most appropriate | | |

Imaging is used to support the diagnosis of infectious endocarditis by demonstration of vegetations of cardiac valves and, in complicated cases, perivalvular abscesses. Imaging is also used to assess the severity of valvular

damage, identify complications, and recognize the presence and severity of heart failure.

## Chest X-ray

The chest x-ray is used to determine cardiac chamber size and the presence and severity of pulmonary venous hypertension and edema; it is necessary for the evaluation of infective endocarditis. It is used to monitor the severity of the hemodynamic consequences of valvular regurgitation caused by infectious endocarditis and to assess response to treatment. Chest x-ray is also used to identify abnormal contour of the great arteries or cardiac chambers which might be indicative of perivalvular abscess. In right-sided endocarditis the chest x-ray is effective for demonstration of pulmonary infarcts and abscesses.

## Cardiac Fluoroscopy

Cardiac fluoroscopy may be indicated for the evaluation of prosthetic cardiac valves afflicted with endocarditis. It is used to determine excess mobility of the valve during the cardiac cycle; this finding may be highly suggestive of valve dehiscence caused by infective endocarditis.

## Transthoracic Echocardiography

Transthoracic echocardiography is necessary in the evaluation of infective endocarditis. Transthoracic echocardiography can demonstrate vegetations on cardiac valves, valvular regurgitation, and perivalvular abscess. It is the most frequently employed imaging study for confirming the diagnosis of infective endocarditis. The demonstration of vegetations by echocardiography establishes the diagnosis. A recent study has shown that criteria for the diagnosis, which includes the findings on transthoracic echocardiography or transesophageal echocardiography, were significantly better than traditional criteria based upon clinical and bacteriologic criteria. While transesophageal echocardiography has been shown to have significantly higher sensitivity than transthoracic echocardiography for identifying vegetations, specificities were similar. The positive predictive value of echocardiography for the diagnosis has been shown to be 97% while the negative predictive value was 94%.

A recent study evaluated the diagnostic value of transthoracic echocardiography and transesophageal echocardiography in relation to the pretest probability of infective endocarditis based upon clinical assessment. This study concluded that echocardiography is not indicated in patients with low probability of endocarditis. Transthoracic echocardiography is the procedure of choice for patients with intermediate or high probability of endocarditis. It concluded also that transesophageal echocardiography should be reserved for patients with prosthetic valves or when transthoracic echocardiography yields intermediate probability results. In right-sided endocarditis, transthoracic echocardiography and transesophageal echocardiography demonstrated a similar number of vegetations and frequency of tricuspid regurgitation.

The size and other characteristics of vegetations on echocardiography have been shown to be useful in predicting complications such as peripheral embolization. Increase or failure to decrease in size of vegetation on serial echocardiograms

during antibiotic therapy has been shown to be predictive of a prolonged and/or complicated course of infective endocarditis.

## Transesophageal Echocardiography

Transesophageal echocardiography is indicated in suspected infective endocarditis for demonstrating vegetations, perivalvular abscess, valvular regurgitation and ventricular function. It is the most sensitive imaging technique for identifying vegetations, which are the hallmark for the definitive diagnosis of infective endocarditis. Criteria for the diagnosis of infective endocarditis using echocardiographic features improves upon the diagnostic accuracy of using clinical criteria alone. Transesophageal echocardiography has better sensitivity than transthoracic echocardiography for detecting vegetations. A recent review has claimed that in experienced hands, transesophageal echocardiography has a greater than 90% sensitivity and specificity for detecting intracardiac lesions associated with infective endocarditis. This review also concluded that a negative transesophageal echocardiography almost always means a very low probability of infective endocarditis.

Transesophageal echocardiography has been shown to be very effective for monitoring the size and other characteristics of vegetation and for detecting complications such as perivalvular abscesses. Transesophageal echocardiography has improved sensitivity and accuracy compared to transthoracic echocardiography for identifying perivalvular abscesses. Transesophageal echocardiography is indicated for suspected infective endocarditis of prosthetic valves; it is significantly more accurate than transthoracic echocardiography. Furthermore, monitoring the size of vegetations during treatment contributes information concerning prognosis and risk of complications.

In a recent study, transthoracic echocardiography was found to be the more cost effective test in patients with intermediate or high pretest probability of infective endocarditis. This study concluded that transesophageal echocardiography should be reserved for patients with suspected infective endocarditis on prosthetic valves or those in whom transthoracic echocardiography yields intermediate probability results.

Transesophageal echocardiography is indicated in many patients with suspected infective endocarditis, especially those in whom transesophageal echocardiography is inconclusive or in patients with suspected perivalvular abscess.

## Radioisotope Scanning

Radioisotope scanning is probably indicated in the evaluation of suspected infective endocarditis. Several types of radioisotope scans may be used for identifying and localizing infected vegetations and perivalvular abscesses. Gallium67 and indium111 labeled white cells are routinely used. Although these techniques are useful in isolated patients, they have a low sensitivity and add little to the usual diagnosis of infective endocarditis.

More recently, immunoscintigraphy using technetium99m labeled anti-NCA-95 antigranulocyte antibodies has been proposed as a method of localization. In one

study, this scan had a sensitivity of 79% and specificity of 82% compared to echocardiography, which had a sensitivity of 88% and specificity of 97%. However, the combination of echocardiography and immunoscintigraphy has a sensitivity and specificity of 100% and 82%, respectively.

### Magnetic Resonance Imaging

Magnetic resonance imaging is probably indicated for the evaluation of infective endocarditis. However, its use should be limited to the evaluation of complications such as perivalvular and myocardial abscesses and infectious pseudoaneurysms. It is less accurate than transthoracic echocardiography and transesophageal echocardiography for identifying valvular vegetations. Cine magnetic resonance imaging and velocity encoded cine magnetic resonance imaging can be used for the semiquantification and quantification of the volume of valvular regurgitation, respectively.

### Computed Tomography

Standard computed tomography and electron beam computed tomography are probably indicated in the evaluation of complications of infective endocarditis, such as the identification of perivascular and myocardial abscesses and infective pseudoaneurysms. Computed tomography may be indicated in right-sided endocarditis for demonstrated septic pulmonary infarcts and abscesses.

Computed tomography is less accurate than transthoracic echocardiography and transesophageal echocardiography for identifying valvular vegetation. Consequently, the role of computed tomography, like magnetic resonance imaging, is for the evaluation of complicated cases of infective endocarditis.

### Catheterization and Ventricular Angiography

Catheterization and ventriculography is indicated in infective endocarditis with congestive heart failure. It may be used to assess the severity of valvular dysfunction and ventricular function prior to surgery. These tests are not indicated for patients with uncomplicated endocarditis on native valves in whom surgical intervention is not contemplated. Catheterization and ventriculography may be indicated for endocarditis of prosthetic valves when echocardiographic results are equivocal.

## CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

# EVIDENCE SUPPORTING THE RECOMMENDATIONS

## TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

Appropriate selection of initial radiologic exam procedures for patients with suspected bacterial endocarditis.

### POTENTIAL HARMS

None identified

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Getting Better

### IOM DOMAIN

Effectiveness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Higgins CB, Levin DC, Bettmann MA, Gomes AS, Grollman J, Henkin RE, Hessel SJ, Kelley MJ, Needleman L, Polak JF, Stanford W, Wexler L, Abbott W, Port S. Suspected bacterial endocarditis. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):73-7. [24 references]

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

1998

### GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

### SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™

### GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Cardiovascular Imaging.

### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Charles B. Higgins, MD; David C. Levin, MD; Michael A. Bettmann, MD; Antoinette S. Gomes, MD; Julius Grollman, MD; Robert E. Henkin, MD; Samuel J. Hessel, MD; Michael J. Kelley, MD; Laurence Needleman, MD; Joseph F. Polak, MD, MPH; William Stanford, MD; Lewis Wexler, MD; William Abbott, MD; Steven Port, MD

### FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

### GUIDELINE STATUS

This is the current release of the guideline.

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2003.

## GUIDELINE AVAILABILITY

Electronic copies: Available (in PDF format) from the American College of Radiology (ACR) Web site.

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## AVAILABILITY OF COMPANION DOCUMENTS

None available

## PATIENT RESOURCES

None available

## NGC STATUS

This summary was completed by ECRI on February 20, 2001. The information was verified by the guideline developer on March 14, 2001.

## COPYRIGHT STATEMENT



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